Claims

885   What is claimed is:

1. An integrated human and computer interactive data mining method comprises the steps of:

     a) Input a database;

890   b) Perform knowledge creation selected from the group consisting of learning, modeling, and analysis using the database to create an initial knowledge model;

     c) Perform at least one query of the initial knowledge model;

     d) Perform visualization processing of the initial knowledge model to create a

895   knowledge presentation output.

2. The integrated human and computer interactive data mining method of claim 1 wherein the initial knowledge model is a regulation tree.

900   3. The integrated human and computer interactive data mining method of claim 1 wherein the knowledge presentation output further comprises rule ranking by information integration.

4. The integrated human and computer interactive data mining method of claim 1
905   wherein the knowledge presentation output includes feature distribution profiles.

5. The integrated human and computer interactive data mining method of claim 1 further comprises a feedback and update request step that updates the initial knowledge model.

910   6. The integrated human and computer interactive data mining method of claim 1 wherein the knowledge creation step further comprises the steps of:

     a) Perform data organization using the database to create formatted data;

b) Perform data modeling using the formatted data to create the initial knowledge model.

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7. An integrated human and computer interactive data mining method comprises the steps of:

a) Input a database;

b) Perform knowledge creation selected from the group consisting of learning,
920   modeling, and analysis using the database to create an initial knowledge model;

c) Perform dynamic learning and knowledge representation using the initial knowledge model and the database to create or update a presentable knowledge model;

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8. The integrated human and computer interactive data mining method of claim 7 further comprises an interactive data mining step between the human and the presentable knowledge model.

930   9. The integrated human and computer interactive data mining method of claim 7 wherein the dynamic learning and knowledge representation step further comprises an update learning step.

10. The integrated human and computer interactive data mining method of claim 7
935   wherein the knowledge creation step further comprises the steps of:

a) Perform data organization using the database to create formatted data;

b) Perform data modeling using the formatted data to create the initial knowledge model.

940   11. The integrated human and computer interactive data mining method of claim 8 wherein the interactive data mining step further comprises a visualization step.

12. The integrated human and computer interactive data mining method of claim 8 wherein the interactive data mining step further comprises a query step.

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13. The integrated human and computer interactive data mining method of claim 8 wherein the interactive data mining step further comprises a feedback and update request step.

950   14. A multiple level integrated human and computer interactive data mining method comprises the steps of:

    a) Input a database;

    b) Perform knowledge creation selected from the group consisting of learning, modeling, and analysis using the database to create an initial knowledge

955   model;

    c) Perform overview interactive data mining and dynamic learning and knowledge representation using the initial knowledge model and the database to create or update a presentable knowledge model.

960   15. The multiple level integrated human and computer interactive data mining method of claim 14 further performs zoom and filter interactive data mining and dynamic learning and knowledge representation using the presentable knowledge model and the database to create or update the presentable knowledge model.

965   16. The multiple level integrated human and computer interactive data mining method of claim 14 further performs details-on-demand interactive data mining and dynamic learning and knowledge representation using the presentable knowledge model and the database to create or update the presentable knowledge model.

970   17. The multiple level integrated human and computer interactive data mining method of claim 14 wherein the knowledge creation step further comprises the steps of:

    a) Perform data organization using the database to create formatted data;

      b) Perform data modeling using the formatted data to create the initial
         knowledge model.

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18. A presentable knowledge model generation method comprises the steps of:

      a) Input formatted data and a decision tree;

      b) Perform rule ranking using the formatted data and the decision tree to create
         ranked output;

980   c) Perform feature profile generation using the formatted data and the decision
         tree to create feature profiles.

      d) Group the ranks and feature profiles to create a presentable knowledge model
         output.

985   19. The presentable knowledge model generation method of claim 18 further comprising
perform contrast example selection using the formatted data and the decision tree to
create contrast examples and group the contrast examples, ranks, and feature profiles to
create a presentable knowledge model output.

990   20. The presentable knowledge model generation method of claim 18 wherein rule
ranking uses global characteristics and population characteristics selected from the set
consisting of:

      a) Local counts;

      b) Local population statistics;

995   c) Global counts;

      d) Global population statistics.

21. The presentable knowledge model generation method of claim 19 wherein the
contrast examples are the high rank samples from both the correct label and the wrong
1000   label population.

22. The presentable knowledge model generation method of claim 18 wherein the feature
profile generation method normalizes the automatically generated features.

1005   23. A tree update learning method comprises the steps of:

        a)   Input formatted data and a decision tree;

        b)   Remove a sample by:

            i.   Subtracting the data from the sample associated terminal node;

            ii.   Updating the statistics of each of the associated non-terminal nodes.

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24. The tree update learning method of claim 23 further comprises a step to remove a rule.

25. The tree update learning method of claim 23 further comprises a step to add a sample

1015   by:

            i.   Adding the data to the sample associated terminal node;

            ii.   Updating the statistics of each of the associated non-terminal nodes.

26. The tree update learning method of claim 23 further comprises a step to add a rule.

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27. An interactive data mining method comprises the steps of:

        a)   Input a presentable knowledge model;

        b)   Perform rule viewing of a terminal node in the presentable knowledge model by a parallel coordinate visualization technique that maps a multiple

1025   dimensional space onto two display dimensions and at least one data item is presented as a polygonal line.

28. The interactive data mining method of claim 27 further comprises a feature viewing method that shows the histograms of the features as encoded bars.

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29. The interactive data mining method of claim 27 further comprises a contrast presentation method that highlights representative samples from the correct label and wrong label.

1035   30. The interactive data mining method of claim 27 performs data mining using multi-level abstraction.